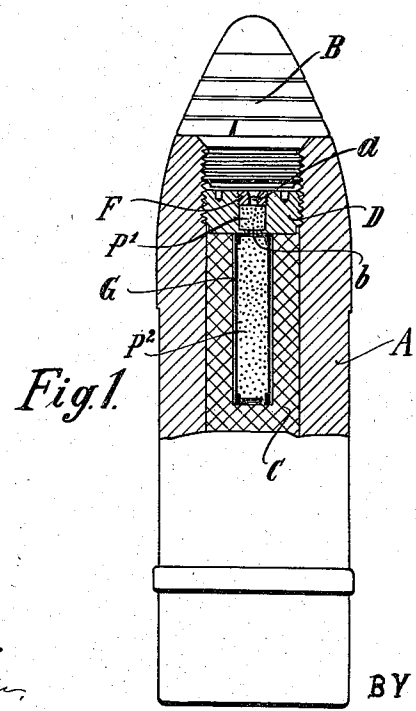
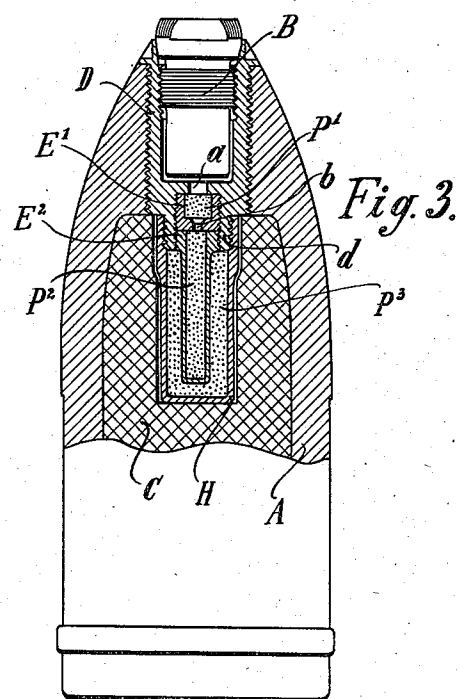
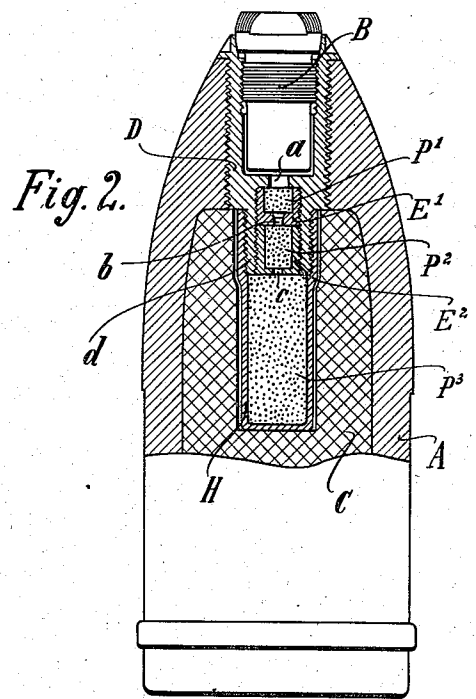


No. 844,225.

PATENTED FEB. 12, 1907.

A. WRATZKE.  
EXPLODING SHELL.  
APPLICATION FILED JAN. 24, 1901.



WITNESSES:  
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# UNITED STATES PATENT OFFICE.

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## EXPLODING SHELL.

No. 844,225.

Specification of Letters Patent.

Patented Feb.-12, 1907.

Application filed January 24, 1901. Serial No. 44,519.

*To all whom it may concern:*

Be it known that I, ALFRED WRATZKE, a citizen of the German Empire, residing at Rüttenscheid, near Essen-on-the-Ruhr, Germany, 149 Essenerstrasse, have invented certain new and useful Improvements in Exploding Shells, of which the following is a specification.

This invention has reference to improvements in high-explosive shells, and has for its object to render the transportation, handling, and firing of this class of projectiles absolutely free from danger.

The shells now in general use are filled with a bursting charge—such as picric acid, gun-cotton, dynamite, &c.—which said charge is difficult to explode, a violent agitation by means of a separate igniting charge being required for its detonation. The explosion is generally effected by the use of fulminate of mercury; but the latter being in itself highly explosive is subject to the danger of being ignited by the concussion in firing the gun, thereby causing bursting of the shell within the barrel. Shells containing an igniting charge of fulminate of mercury must always be transported and handled with extra great care, while even then accidents are not excluded and do occur. To guard against such accidents, attempts have been made to use a different igniting charge for the shells. Thus, for example, in place of fulminate of mercury a charge of rapid-burning gun powder inclosed within a strong but brittle case of cast-steel or of cast-iron and surrounded by the bursting charge has been proposed. Firing tests, however, have demonstrated that with such an igniting charge a simple explosion is caused, which breaks the shell in a small number of fragments, and consequently such shells do not answer the required purposes.

The object of the present invention is to provide an igniting charge of gunpowder or of a mixture of substances jointly producing an action similar to gunpowder—that is to say, having the quality of being but slightly sensitive to shock—and insuring the detonation of the bursting charge by having the igniting charge divided into several parts inclosed within separate but adjoining chambers arranged successively in such relation that each succeeding part is ignited by and under the influence of the burning of the preceding part.

The nature of the invention will best be understood when described in connection with the accompanying drawings, in which—

Figure 1 represents a longitudinal section of a shell embodying the invention and provided with a firing charge divided into two parts. Fig. 2 is a similar longitudinal section showing the igniting charge divided into three parts. Fig. 3 is a modified form of Fig. 2.

Similar letters of reference designate corresponding parts throughout the several views of the drawings.

Referring at present to Fig. 1, the letter A designates the body of the projectile, and B the fuse, which is assumed to be a combination-fuse of the usual construction. Within the cavity of the body A is placed a bursting charge C, of picric acid or other material slightly sensitive to shock, and the cavity is closed by the screw-plug D. This screw-plug has a chamber therein filled with the primary igniting charge P', of a material that is only slightly sensitive to shock, and which chamber communicates, by means of the channel *b*, with the cavity of the projectile. The outer end of the chamber—that is, the end toward the combination-fuse B—is closed by a screw-plug F, provided with a flame-channel *a*. A secondary and larger igniting charge P<sup>2</sup>, of a material slightly sensitive to shock, is placed within a thin brass capsule G, of which the cover facing the igniting-charge P' is provided with a flame-channel. This capsule G is inserted into a central cavity of the bursting charge C. After the shot is fired the fuse B explodes the primary igniting charge P' either after the expiration of the time fixed or on impact, according to the adjustment. The screw-plug D with its restricted opening *b* forms a means which firmly confines the primary igniting charge and directs the heat-waves from the said primary charge on the secondary charge P<sup>2</sup> sufficiently to detonate the secondary charge—that is to say, the plug and its opening forms means which concentrates the heat of combustion of the igniting charge or intensifies the action of the heat-waves sufficiently to detonate the secondary charge. The detonation of the secondary igniting charge being induced by an originally violent explosion of the primary igniting charge takes place much more violently

than if merely ignited directly from the fuse, and consequently has a sufficiently great exciting effect on the bursting charge C to positively insure detonation of the latter.

5 Irrespective of relative proportions and of the special construction of the fuse B—which in Fig. 2 is shown as a concussion-fuse—the shell shown in Fig. 2 does not differ from that shown in Fig. 1 except in having  
10 three igniting charges, P' P<sup>2</sup> P<sup>3</sup> each of material but slightly sensitive to shock, instead of two such charges. The charges P' and P<sup>2</sup> are inclosed within chambers formed within bushings E' and E<sup>2</sup>, screwed into a cylin-  
15 cal bore of the screw-plug D, inserted into the mouth of the shell. The third charge is placed within a capsule H, screwed on the end *d* of the plug D, and said capsule is placed in the central cavity of the bursting  
20 charge C. Communication between the charge P' and the fuse B is established by the flame-channel *a*, connection between the charge P' and the charge P<sup>2</sup> by the channel *b*, and communication between the charge P<sup>3</sup>  
25 by the channel *c*. The bushing E<sup>2</sup> and its opening *c* cause the secondary charge P<sup>2</sup> to act in the same manner as the plug D, Fig. 1, or the bushing E', Fig. 2.

The shell shown in Fig. 3 differs from that  
30 shown in Fig. 2 only by having the bushing E<sup>2</sup> drawn or dished, so as to extend into the charge P<sup>3</sup>. In view of this construction the two charges P<sup>2</sup> and P<sup>3</sup> are located concentrically with each other and to the bursting  
35 charge, and the flame-channel *c* of Fig. 2 may be dispensed with, since the thin bushing readily breaks under the pressure of the second igniting charge.

The mode of action of the two last-men-  
40 tioned constructions corresponds to that of the arrangement shown in Fig. 1 except that the detonation of the third and last igniting-charge is greater. When the projectile strikes the target, the charge P' is first ex-  
45 ploded by the fuse B, whereupon progressively greater detonations take place in the charges P<sup>2</sup> and P<sup>3</sup> successively, the last being sufficient to cause detonation of the bursting charge C.

50 For insuring the positive action of the igniting charge in the several modifications herein shown it is important that the first or primary charge should be firmly confined, while this is not essential to the last charge.  
55 For instance, the last igniting charge, or the charge located within the bursting charge, may be contained in a paper tube. The capsule H (shown in Figs. 2 and 3) is of no importance for ignition and only serves the  
60 purpose of storing the igniting charge and the plug as a unit, which can be readily inserted into the projectile.

Since the materials (gunpowder, &c.) which are herein used for the igniting  
65 charge are not exploded by impact, like ful-

minate of mercury, transportation, handling, and firing of the shell so constructed are entirely free from danger. At the same time a bursting charge may be employed which requires a very great explosion for its  
70 detonation, for such a great detonating effect is positively assured by the successive detonations of progressively-increasing force.

What I claim as new is—

1. In a high-explosive shell, the combina-  
75 tion with the fuse and the bursting charge slightly sensitive to shock, of a primary igniting charge of material slightly sensitive to shock, a secondary igniting charge of material slightly sensitive to shock, intermediate the primary igniting charge and the  
80 bursting charge, and means concentrating the heat of combustion of the primary igniting charge on the secondary igniting charge, sufficiently to cause detonation of said sec-  
85 ondary charge.

2. In a high-explosive shell, the combina-  
90 tion with the fuse and the bursting charge slightly sensitive to shock, of an igniting charge of material slightly sensitive to shock, and means concentrating the action of the heat of combustion of the igniting charge, sufficiently to cause detonation of the burst-  
95 ing charge.

3. In a high-explosive shell, the combina-  
95 tion with the fuse and the bursting charge slightly sensitive to shock, of a primary igniting charge, of material slightly sensitive to shock, one or more igniting charges of material slightly sensitive to shock, interposed between the said primary igniting charge and the bursting charge; and means confining and concentrating the action of the heat-waves of the primary igniting charge during  
100 burning, sufficiently to cause a detonation of the adjacent igniting charge, to develop successively-increasing violence in the action of each charge on that which follows and causing detonation of the bursting charge.

4. In a high-explosive shell, the combina-  
105 tion with the fuse and the bursting charge slightly sensitive to shock, of an igniting charge, and means firmly confining said igniting charge and provided with a restricted opening adapted to intensify the action of the heat-waves from said igniting charge sufficiently to detonate the bursting charge.

5. In a high-explosive shell, the combina-  
110 tion with the fuse and the bursting charge slightly sensitive to shock, of a primary igniting charge, a secondary igniting charge, and means firmly confining the primary igniting charge and provided with a restricted opening sufficiently directing the heat-waves from the primary charge on the secondary  
115 charge to detonate the same and thereby cause a detonation of the bursting charge.

6. In a high-explosive shell, the combina-  
120 tion with the fuse and the bursting charge slightly sensitive to shock, of a primary ig-

5 niting charge, a secondary igniting charge,  
and means concentrating the action of the  
heat-waves of the primary igniting charge  
upon the secondary igniting charge suffi-  
ciently to detonate the same and to thereby  
insure detonation of the bursting charge.

In testimony whereof I have hereunto set

my hand in the presence of two subscribing  
witnesses.

ALFRED WRATZKE.

Witnesses:

OSCAR HARTMANN,  
P. LIEBER.